

II. REMARKS

A. Election/Restriction

The method claims of 1-17 and 21-26 were withdrawn from consideration by the Examiner based on his conclusion that the invention could be manufactured using a different process than claimed in the Application. Applicant chooses not to traverse this conclusion cancelling claims 1-17 and 21-26 at this time, but reserves the right, upon allowance of a generic claim, to re-introduce these claims in dependent form.

The claims of 29 and 31 were withdrawn from consideration by the Examiner. In the present response, applicant herein respectfully traverses the withdrawal of claims 29 and 31 from consideration. Applicant has amended Claim 18 to address the Examiner's remarks as expressed in the last office action. Amended claim 18 should now put dependent claims 29 and 31 in a position for allowance and are hereby submitted for consideration by the Examiner.

B. Traversal/Amendments

Applicant herein traverses the rejections of the claims in the Office Action based on prior art. Furthermore, Applicant has prepared additional claims in an attempt to clarify the novel elements of the invention. Amended claim 18 and claims 19, 20, 27, 28 and 30, which are dependent on amended claim 18, should now be in a position for allowance and are hereby submitted for consideration by the Examiner. Further, Applicant has prepared new claims 32-39 and are hereby submitted for consideration by the Examiner.

III. DISCUSSION REGARDING REJECTION OF CLAIMS 18-20, 27, 28, AND 30.

Applicant is disposed to traverse the rejection of claims 18-20, 27, 28, and 30 on the basis that the references cited in the Office Action do not, in Applicant's opinion, disclose elements that read on Applicant's invention. A claim by claim traversal follows. However, Applicant has decided

to amend the claims, as shown above, in an attempt to make the distinctions between the cited prior art and Applicant's claims even more clear. Further, new claims 32-39 are included.

A. Glance Distinguished

Claim 18 was rejected on the following basis: That Glance (US Patent No. 3,863,181), in figure 2, discloses a printed circuit board comprising: a plurality of internal signal traces (205, 204) located on a dielectric layer (203), wherein the dielectric layer is suspended in air between two flat metal plates (213, 212, column 3, line 39).

Applicant respectfully disagrees that the Glance reference discloses the invention described herein. First, figure 2 of Glance, as well as the entire Glance patent, does not disclose a printed circuit board. Glance describes and claims a "mode suppressor for strip transmission lines", specifically strip transmission lines enclosed in a conducting shield. Glance makes no reference to a printed circuit board. Glance states that figure 2 is a "stripline structure", which is generally a conductor sandwiched between two parallel ground planes. The spacers referenced in Glance (201, 213, 200, 211, and 212) are separate pieces, and not part of a printed circuit board.

Further, Glance does not comprise internal signal traces. The Glance "conductor strips" (204, 205), even when the parts are combined, are open to the outside air, and are thus not "internal". Even when the three parts of the Glance device are combined, the traces are not internal because they are open at the ends.

Moreover, the dielectric layer in the Glance device is not suspended in air. Specifically, Figure 2 in Glance clearly shows a dielectric fitted against the bottom plate with no air under the dielectric. It cannot be assumed that the air spaces in Glance are channels. Glance makes no mention of how the facing end and the back end of the cavity are treated. Further, it cannot be

assumed that the Glance air spaces are open-air (or provide ambient air) because end plates are mounted to the conductor on the dielectric.

Claim 19. "The printed circuit board of claim 18 further comprising open air channels located in the flat metal plates above and below at least one of the signal traces" was rejected on the basis that Glance disclosed these elements. However, Figure 3 of Glance demonstrates that there is no open-air channel in the flat metal plates above and below. In fact, the figure shows a dielectric lying on a metal plate with no air below it. Clearly Glance does not disclose the use of an air dielectric above and below the signal traces.

The Office Action claims that Glance further discloses the width of open-air channels are wider than at least one of the internal signal traces (width of channel 206, 207 are wider than the signal traces, see figure). However, Figure 3 demonstrates that there is no open-air channel in the bottom plate at all, thus making the statement impossible. Furthermore, figure 3 refutes the contention that Glance discloses the open-air channels in the flat metal plates located above and below at least one of the signal traces. A careful review of figure 3 shows this not to be the case.

Applicant contends that these differences between Glance and the invention claimed herein distinguish the two inventions. Furthermore, the claim language of new claims 32-39 provide a further level of distinctiveness.

The present invention is further contrasted from the Glance patent by provisions to allow air to flow from the inside channel to the outside for pressure equalization and protection from damage from these air pressure concerns.

Regarding claim 30, Glance discloses air being is used as the primary dielectric in order to pass all high-frequency signals without discrimination (as the channels are filled with the air, the air works as dielectric). Additional differences between the application and Glance are as follows:

- a. Glance does not mention air.
- b. The Glance claims do not disclose air as a dielectric.
- c. The assumption that air fills the open area is just an assumption and not fact. The void could even be filled with a vacuum or any other gas.
- d. The lack of the mention of air as the dielectric by Glance makes it clear that this feature is outside the scope of his invention, as evidenced by the title of his invention "mode suppression for strip transmission lines. Glance patented a method for suppressing waveguide modes that are present in a rectangular metal structure when excited with microwave RF energy.
- e. The Glance patent focuses upon the suppression of parasitic modes of propagation in the waveguide structure. The claims relate to the means for suppression of modes associated with vertical currents. The mechanical means for suppressing these currents in the claims is by a groove in one side of the shielding structure, blocking this energy, or by the inclusion of resistive or glossy materials to absorb this energy. The only PCB's being considered are simple one or two layer devices.

- f. The present invention is for an implementation of air dielectric in a multi-layer PCB and has no concern for waveguide modes.

B. Dittmer Distinguished

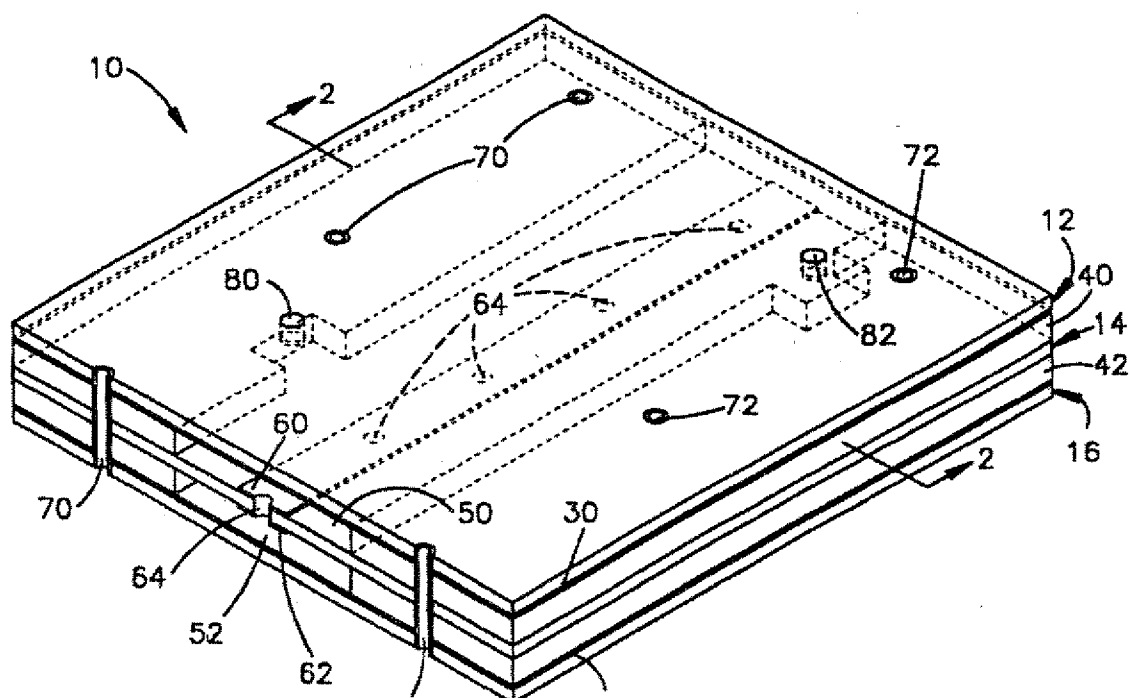
Claims 18-20, 27, 28 and 30 were rejected under 35 U.S.C. 102(b) as being anticipated by Dittmer (US Patent No. 5,712,607). Applicant traverses the objections, below. Please note, however, that Applicant has also filed new claims to further clarify and distinguish the invention.

With respect to the claims rejected based on Dittmer, the Office Action states that Figure 1 and 2 of Dittmer discloses a printed circuit board comprising: a plurality of internal signal traces (60, 62) located on a dielectric layer (22), wherein the dielectric layer is suspended in air between two flat metal plates (30, 32), and wherein the dielectric layer is suspended in air between two flat metal plates (30, 32). Applicant disagrees. The dielectric layer disclosed in Dittmer is not suspended in air between two flat metal plates. The Dittmer dielectric layer is suspended in air between two intermediate dielectric layers. The Dittmer invention discloses a dielectric layer used as a spacer above and below the thin dielectric layer. See drawing item 40 and 42. This is a critical distinction. There are many performance benefits to enclosing the air channel in metal rather than dielectric.

The Dittmer air channels are not in metal plates as stated in the Office Action, but rather are in the dielectric material. Dittmer's Description of the preferred Embodiment beginning in line 5.

“The air-dielectric stripline 10 is illustrated in FIGS. 1 and 2 and includes a laminated structure including a plurality of planar dielectric layers constructed of suitable non-conductive material of the type used for printed circuit boards. This structure includes a top dielectric layer 12, an intermediate dielectric layer 14 and a bottom dielectric layer 16. These layers are spaced from each other in parallel planes with layer 14 being located intermediate to layers 12 and 16. These are relatively thin layers and, for example may each have a thickness on the order of 20 mils. Each of these layers has upper and lower oppositely directed faces. Thus, layer 12 has an upper face 18 and a lower face 20. Layer 14 has an upper face 22 and a lower face 24.

As a further illustration of the differences, Dittmer defines the intermediate spacer layer as approximately 100 mils thick. See Dittmer Description of Preferred embodiment, lines 36-39. Layers 40 and 42 are somewhat thicker and in the example being presented, may each be on the order of 100 mils in thickness. Items 30 and 32 are the only metal conductive layers and are not used for spacing, but are approximately 1 mil thick. Each ground plane takes the form of a thin metal layer which is initially applied to one face of a dielectric layer. In the example being presented, each layer may be on the order of 1 mil in thickness. So, in Dittmer, the spacing layer is the dielectric layer, not the conductive layer.



The Dittmer invention utilizes ‘forced’ or ‘pressurized’ air, as opposed to Applicant’s invention which claims “open air” channels. The following excerpts are taken from Dittmer Description of preferred embodiment column 2 line 66 and continuing.

“Air cooling of the stripline may be obtained by air flowing through channels 50 and 52. This may be assisted by providing a *pressurized* source of air and connecting it to a suitable inlet passage 80 in layer 12 so that air may flow into the chamber 50 and thence longitudinally along the upper trace 60 and exit as through an exit passageway 82. It is to be understood that a similar inlet passageway and exit passageway are provided in layer 16 for connection with channel 52.”

Dittmer: column 3 line 12

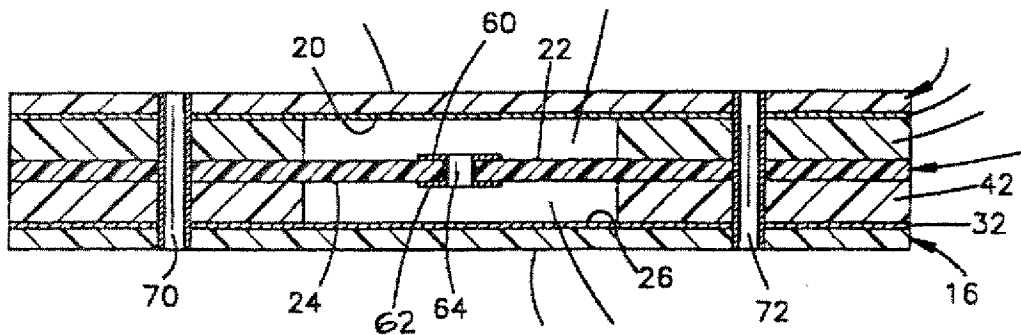
“The construction also allows for high-power transmission, by a forced-air cooling of the stripline by air flowing through channels 50 and 52 during operation.”

Dittmer’s claims 1, 9 and 10 claim

“each said spacer layer having an airtight channel formed therein with longitudinally extending solid sidewalls in said spacer defining upper and lower chambers on opposing faces of said intermediate layer, said channel allowing for *forced-air* cooling by air flowing through said channel during operation....”

Dittmer has not disclosed air channels which are open to relieving air pressure and to protect the board from such damage as delamination. Instead, Dittmer has claimed a method of cooling the board through the use of: airtight channels, forced air flow from a pressurized source, and cooling of the board through these channels.

Dittmer Drawing



C. Tuck (US Patent No. 3,329,898) Distinguished

Tuck's Figure 4 discloses traces (33) on dielectric 32 with channels formed on upper and lower side of the traces by plates (26, 27). This patent shows a trace on a dielectric suspended between two metal channels as was the common method of making suspended-substrate transmission line. Figure 4 shows clearly that the bottom plate 27 is cut out to incorporate the dielectric in the gap. It also shows that the top and bottom plates are separate. The cabinet is assembled and mentions the use of hinges and a metal cabinet structure.

Tuck does not disclose a printed circuit board. Tuck disclosed a "cabinet" with a wall containing a strip line structure. There is neither a multi-layer PCB, nor a structure using air dielectric.

Figure 1 illustrates a cabinet, not a printed circuit board. There is a top and bottom rigid sheet metal plate with a coaxial connector shown connecting to the top and bottom plates. There are side plates, front and back plates and knobs and controls of various kinds.

Column 1 line 10 states that "This invention relates generally to a cabinet for a microwave communications system and more particularly to a cabinet which incorporates a portion of the microwave circuit." Applicant's invention is not associated with a microwave apparatus, nor is it related to a cabinet. The present invention is a multi-layer printed circuit board, and is laminated together. It has no microwave components built into it.

Tuck's Figures 5, 6, and 7 show the detail of a transmission line with

- a cross section cut away of a rigid metal plate with a milled out channel;
- two coupled line sections suspended in the channel, comprising a microwave directional coupler for sampling some of the energy; and
- column 2 line 43 “ ... the upper plate forms a portion of the directional coupler and filter for the transmitter.”

Tuck's Figure 2 at column 1 line 66 shows an exploded view of the cabinets, showing that the upper and lower plates 11 and 12 are each separable and incorporate strip line circuits. Note that the two plates are separable. These were bolted or otherwise secured together.

In contrast Applicant's invention claims a laminated multi-layer printed circuit board which cannot be separated. As such, very little similarity exists between Tuck and Applicant's invention.

IV. CONCLUSION

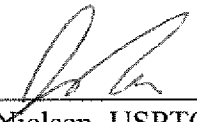
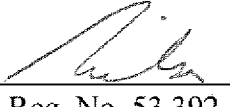
In light of the above amendments and remarks, the Applicant respectfully requests that the Examiner grant allowance to the pending claims. Applicant believes that the claims are proper, definite, and define novel subject matter that is also non-obvious. As such, Applicant believes that the Application is in a position for allowance.

If for any reason, this application is not believed to be in full condition for allowance, Applicant respectfully requests the constructive assistance and suggestion of the Examiner pursuant to M.P.E.P. section 2173.02 and section 707.07(j) in order that the undersigned can place this application in fully allowable condition.

Respectfully submitted,

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